WHAT IS CLAIMED IS:

1. A method for detecting misalignment of two periodic structures placed next to each other so that they are periodic substantially along a first line, comprising:

illuminating a portion of each of the two structures using radiation that is substantially coherent, each of said portions having a dimension along the first line larger than the period of the corresponding structure;

detecting diffracted radiation signals from the illuminated portions of the structures to provide at least one output signal; and

determining from the at least one output signal a misalignment between the structures.

2. The method of claim 1, further comprising dividing a substantially coherent beam of radiation into a first and a second beam that are substantially coherent, wherein said illuminating employs radiation from the first beam to illuminate one of the structures and radiation from the second beam to illuminate the other structure.

3. The method of claim 2, wherein said dividing includes passing said substantially coherent beam of radiation to a birefringent or acoustooptic element.

4. The method of claim 3, further comprising modulating the first beam at a first frequency before radiation from the first beam is employed to illuminate said one of the structures.

5. The method of claim 2, further comprising modulating the second beam at a second frequency before radiation from the second beam is employed to illuminate said other one of the structures.

6. The method of claim 5, wherein said detecting detects at a frequency that is proportional to a difference between the first and second frequencies, or between multiples thereof.

7. The method of claim 5, wherein said modulating includes splitting said coherent beam into a third and a fourth beam, modulating the third and fourth beams by different frequencies and combining the modulated third and fourth beam into a combined beam.

8. The method of claim 7, wherein said splitting into the third and fourth beams employs a polarizing beam splitter.

9. The method of claim 7, wherein said combined beam is substantially coherent and is divided into said first and second beams by the dividing.

10. The method of claim 1, wherein said illuminating uses radiation that contains a component at a second frequency, and said detecting detects at a frequency that is proportional to a difference between and/or sum of the first and second frequencies, or a difference between and/or sum of multiples thereof.

11. The method of claim 2, further comprising:

combining the diffracted radiation signals from the illuminated portions of the two structures; and

supplying the combined diffracted radiation signals to one or more detectors.

12. The method of claim 11, wherein said dividing or combining employs a birefringent or acoustooptic element.

13. The method of claim 12, further comprising causing relative motion between the element and the structures, and wherein said determining includes calculating a phase difference between the diffraction radiation signals that are detected from the two structures when said relative motion is caused.

14. The method of claim 11, wherein said combining combines a first order diffraction signal from each of the two structures.

15. The method of claim 14, wherein said combining combines a positive first order diffraction signal from one of the two structures with a positive first order diffraction signal from the other of the structure and combines a negative first order diffraction signal from one of the two structures with a negative first order diffraction signal from the other of the structure.

16. The method of claim 1, further comprising causing a change in the relative phase between radiation illuminating one of the two structures and radiation illuminating the other of the two structures, or between the diffracted radiation signals from one of the two structures and the diffracted radiation signals from the other of the two structures.

17 The method of claim 1, wherein said illuminating employs a single beam to illuminate the two portions of the two structures, with a part of the beam illuminating the portion of one structure, and another part of the beam illuminating the portion of the other structure.

18. The method of claim 1, wherein said two periodic structures are also periodic substantially along a second line transverse to the first line, and wherein said determining determines misalignments between the structures along the first and second lines.

19. A apparatus for detecting misalignment of two periodic structures placed next to each other so that they are periodic substantially along a first line, comprising:

a source providing a radiation beam that is substantially coherent to illuminate a portion of each of the two structures, each of said portions having a dimension along the first line larger than the period of the corresponding structure;

two or more detectors, each detector detecting a diffracted radiation signal from the illuminated portion of each structure to provide an output signal; and

a processor determining from said output signals any misalignment between the structures.

20. The apparatus of claim 19, further comprising a first device dividing a substantially coherent beam of radiation into a first and a second beam that are substantially coherent, wherein radiation from said first beam illuminates one of the structures and radiation from the second beam illuminates the other of the structures.

21. The apparatus of claim 20 wherein said first device is a birefringent or acoustooptic element.

22. The apparatus of claim 21, further comprising an instrument that causes the first device to move along a second direction substantially normal to the first line when said at least one detector detects the diffracted signals, and wherein said processor calculates a phase difference between the output signals provided by the two or more detectors when said relative motion is caused.

23. The apparatus of claim 20, wherein said first device has an optical axis at an angle of about 45 ° to one side of the prism.

24. The apparatus of claim 20, further comprising a second device combining the diffracted radiation signals from the illuminated portions of the two structures and supplying the combined diffracted radiation signals to the detectors.

25. The apparatus of claim 24, wherein said first or second device includes a common birefringent or acoustooptic element.

26. The apparatus of claim 25, further comprising an instrument causing relative motion between the element and the structures, and wherein said processor includes calculating a phase difference between the output signals when said relative motion is caused.

27. The apparatus of claim 24, wherein said second device combines a first order diffraction signal from each of the two structures.

28. The apparatus of claim 27, wherein said second device combines a positive first order diffraction signal from one of the two structures with a positive first order diffraction signal from the other of the structure and combines a negative first order diffraction signal from one of the two structures with a negative first order diffraction signal from the other of the structure.

29. The apparatus of claim 19, further comprising an instrument that causes a change in the relative phase between radiation illuminating one of the two structures and radiation illuminating the other of the two structures, or between the diffracted radiation signals from one of the two structures and the diffracted radiation signals from the other of the two structures.

30. The apparatus of claim 19, further comprising a first modulator modulating the first beam at a first frequency before radiation from the first beam is employed to illuminate said one of the structures.

31. The apparatus of claim 30, further comprising a second modulator modulating the second beam at a second frequency before radiation from the second beam is employed to illuminate said other one of the structures.

32 The apparatus of claim 31, further comprising a phase detector detecting the outputs at a frequency that is proportional to a difference between the first and second frequencies, or between multiples thereof.

33. The apparatus of claim 30, further comprising a second device that splits said coherent beam into the first and second beams, and combines the modulated first and second beams into a combined beam.

34. The apparatus of claim 33, wherein said second device includes a polarizing beam splitter.

35. The apparatus of claim 33, wherein said combined beam is substantially coherent and is divided into said first and second beams by the first device.

36. The apparatus of claim 19, wherein said radiation beam contains a component at a second frequency, and said detectors detect a frequency that is proportional to a difference between and/or sum of the first and second frequencies, or a difference between and/or sum of multiples thereof.

37 The apparatus of claim 19, wherein said source provides a single beam to illuminate the two portions of the two structures, with a part of the beam illuminating the portion of one structure, and another part of the beam illuminating the portion of the other structure.

38. The apparatus of claim 19, wherein said two periodic structures are also periodic substantially along a second line transverse to the first line, and wherein said processor determines misalignments between the structures along the first and second lines.

39. A method for controlling lithographical processing of substrates by detection of misalignment of two periodic structures placed next to each other so that they are periodic substantially along a first line, comprising:

illuminating a portion of each of the two structures using radiation that is substantially coherent, each of said portions having a dimension along the first line larger than the period of the corresponding structure;

detecting diffracted radiation signals from the illuminated portions of the structures to provide at least one output signal;

determining from the at least one output signal a misalignment between the structures; and

adjusting a lithographical instrument in response to the misalignment.

40. The method of claim 39, wherein said adjusting adjusts a lithographical stepper.

41. A apparatus for controlling lithographical processing of substrates by detection of misalignment of two periodic structures placed next to each other so that they are periodic substantially along a first line, comprising:

a source providing a radiation beam that is substantially coherent to illuminate a portion of each of the two structures, each of said portions having a dimension along the first line larger than the period of the corresponding structure;

two or more detectors, each detector detecting a diffracted radiation signal from the illuminated portion of each structure to provide an output signal; and

a lithographical instrument;

a processor determining from said output signals any misalignment between the structures and providing information concerning the misalignment to the lithographical instrument.

42. A method for providing yield information by detection of misalignment of two periodic structures placed next to each other so that they are periodic substantially along a first line, comprising:

illuminating a portion of each of the two structures using radiation that is substantially coherent, each of said portions having a dimension along the first line larger than the period of the corresponding structure;

detecting diffracted radiation signals from the illuminated portions of the structures to provide at least one output signal;

determining from the at least one output signal a misalignment between the structures; and

providing yield related information in response to the misalignment.

43. A apparatus for providing yield related information by detection of misalignment of two periodic structures placed next to each other so that they are periodic substantially along a first line, comprising:

a source providing a radiation beam that is substantially coherent to illuminate a portion of each of the two structures, each of said portions having a dimension along the first line larger than the period of the corresponding structure;

two or detectors, each detector detecting a diffracted radiation signal from the illuminated portion of each structure to provide an output signal; and

one or more processors determining from said output signals any misalignment between the structures and providing yield related information.